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Nebraska Earth Systems Education Network – Winter 2003

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First Annual Junior Science and Humanities Symposium

Compiled by Kylee Anderson, NESEN Coordinator

The first annual Junior Science and Humanities Symposium for Nebraska, Oklahoma, and Kansas will be on March 30 and 31. The symposium is being held on the campus of Oklahoma State University. It is part of a national program of the Academy of Applied Science and the U.S. Army, Navy, and Air Force. Their objective is to find talented youth and to encourage the development of their scientific interests and abilities. Outstanding high school science and math students are invited to present an original mathematics or science research paper, poster, or attend the presentation sessions. The student with the best paper will be offered a $4,000 undergraduate scholarship and invited to present his or her paper at the National Junior Science and Humanities Symposium. Twenty-four students will earn scholarship money at the national level as well.

If you are interested, please encourage your students to participate in this year's symposium. There are stipends available for teachers and lodging and most food expenses will be provided for participants. The deadline for teacher and student applications is March 7. Please apply online at http://www.okstate.edu/education/jshs/index.htm. If you have specific questions, please contact Brenda Solomon or Chris Moseley of Oklahoma State at (800) 765-8933.

Massive Alaskan Earthquake Affects Nebraska's Water-Level Recorders

By Charles Flowerday, Editor, Conservation and Survey Division

An odd coincidence of Earth science visited Nebraska on Nov. 3, 2002. On this day, the second of two major earthquakes over a span of a few weeks hit central Alaska. Just hours before the Alaska quake, another much smaller one hit near O'Neill, Nebraska. Unrelated geologically, the O'Neill quake registered 4.3 on the Richter scale, cracking basement walls and knocking some items off shelves, whereas the Alaskan quake, of a magnitude of 7.9 on that scale, was the largest in the world in 2002 and one of the largest ever in the U.S. It even showed up in water-level records, or hydrographs, kept by the University of Nebraska Conservation and Survey Division (CSD) in eastern and south-central Nebraska.

"The Alaskan earthquake showed up on the Aurora recorder's groundwater-level graph November 3, making the water table move about 0.6 of a foot," said Jerry Leach, CSD water-level technician. This means the water level briefly jumped about three inches up and down from the norm. It also showed up in a recorder well near Mead, where the water level in the well bounced about 0.1 of a foot, Leach said.

"Earthquake shocks can produce small fluctuation in wells called 'hydroseisms'," CSD associate geoscientist Scott Summerside explained. "They result from the compression and expansion of elastic, confined aquifers as an earthquake waves passes," he said. In a confined aquifer, water exists under pressure as a result of a layer of fine-grained sediment that retards water movement. The recorder near Aurora also documented the effects of a very powerful quake that shook Mexico's west coast in 1995, showing a three-inch jump. Earthquakes are generally strongest and most frequent where vast lithospheric plates bump into and slide past one another, particularly evident on the west coast of North America. The ancient subsurface equivalent of such features or their effects, such as folding and faulting, may be responsible for smaller quakes in the interior of continents, as in the Alaska quakes. The O'Neill quake may have resulted from activity along a

gentle subsurface arch in the Earth's crust in that area and from activity along an ancient boundary between continental plates, said Matt Joeckel, CSD geologist.

Since 1865, there have been 59 reported earthquakes that have had epicenters in Nebraska. For further information on quakes in Nebraska, particularly the publication *Earthquakes in Nebraska*, contact the Conservation and Survey Division; call (402) 472-7523 or email csdsales@unl.edu.

Model of Agriculturally Dominated Ecoregions Flexible Yet Objective

By Charles Flowerday, Editor, Conservation and Survey Division

A computer model for delineating agroecoregions, developed by a University of Nebraska-Lincoln geographer and his student, has addressed two of the more pressing needs facing agricultural and environmental researchers in the design of such models. The project "Designating Ecological Regions in Agriculturally Oriented Landscapes" was applied to Nebraska and overcomes the subjectivity inherent in many ecoregion designations, according to the principal investigator of the project, Sunil Narumalani, associate professor with the UNL School of Natural Resource Sciences (SNRS) and the Conservation and Survey Division (CSD). In addition, the model can be geared to a wide variety of ecological conditions and agricultural systems.

"The beauty of this model is that it can be used for any purpose. We wanted to develop an ecoregion model that would be automated. It's more quantitative and less subjective," Narumalani said of the work funded by a U.S. Department of Agriculture grant with co-investigator Yingchun Zhou, formerly a graduate student in the UNL Department of Geography.

The model is flexible enough to divide the state from two to 60 ecoregions and can be used in drought planning, with a particular emphasis on management of irrigated and dryland cropping systems; management of areas with mostly native vegetation; allocation of USDA farm bill resources, for example, where farmers might need help due to climatic or economic stress; and for broader planning purposes, such as determining what crops are best suited to which ecological region, Narumalani explained. While designed with agricultural users in mind, it can be adjusted to incorporate data from pre-settlement landscapes as well.

At the coarsest level, the model breaks the state into a moist subhumid region in the east and a semi-arid region in the west, the latter consisting of the Sand Hills and the Panhandle and southwestern Nebraska tablelands. The moist subhumid region can be broken down into eight subregions, and the semi-arid region can be separated into twelve subdivisions. For more information, contact Sunil Narumalani at (402) 472-9842, or e-mail sunil@calmit.unl.edu.

Teacher Workshop on Evolution at UNL

Compiled by Kylee Anderson, NESEN Coordinator

An all-day workshop concerning evolution will be offered to teachers on Saturday, February 22. The workshop, "Evolution's examiners: Biological and Geological research at UNL", will begin at Morrill Hall and provide participants the opportunity to interact with bio- and geo-scientists in their labs. During the workshop, teachers will participate in two of four in-lab seminars. The UNL scientists hosting teachers are Dr. Guillermo Orti (molecular systematics-Biological Sciences), Dr. David Watkins (nanno-paleontology-Geosciences), Dr. Michael Voorhies (vertebrate Paleontology-Geosciences/State Museum), and Drs. Alexandra Basolo and William Wagner (evolution of reproductive traits-Biological Sciences). Following lunch at Morrill Hall, Dr. Bob Hunt (Geosciences/State Museum) will deliver a keynote presentation focusing on human evolution. Finally, there will be small group round-table discussion with UNL scientists Diana Pilson (co-evolution-Biological Sciences), Al Kamil (evolutionary medicine-Biological Sciences), and Norm Smith (responding to the challenge of creationists). Interested teachers can get more information and register online at http://www.unl.edu/scimath/, under the 'programs and events' category.

Recharge Maps to Assist Management of Ground and Surface Water

By Charles Flowerday, Editor, Conservation and Survey Division

Two first-of-their-kind groundwater recharge maps for Nebraska should help decision makers at the state or regional level plan for better management of groundwater and surface water. Hydrologist Joe Szilagyi and groundwater geologists Ed Harvey and Jerry Ayers from the University of Nebraska-Lincoln produced these maps. They are intended to help modelers and resource managers investigate general relationships in groundwater pumping, nonpoint-source water pollution, stream-aquifer interaction, and streamflow allocation. Using some innovative methods, the two digital maps calculate base recharge and total recharge, respectively, for the state over a 30-year period. Recharge is the amount of water from precipitation that replenishes groundwater in storage.

"I think you get a good general picture of the recharge for the state with this technique," Szilagyi said. The average annual total recharge for the state was 48 millimeters, or about 1.92 inches. However, as with all averages, this is somewhat misleading because the gradient ranges from 3-14 millimeters (0.12-0.56 inches) in an arc around the border with Colorado to a high of 120-140 millimeters (4.72-5.51 inches) in the far southeastern corner.

In addition to the gradient radiating from the border with Colorado and generally trending west to east, the highest rates were in the valleys of the Elkhorn, Platte, Missouri and Big and Little Nemaha rivers and in the Sand Hills.

Szilagyi also explained that the map is a general assessment to be used for water-resource planning and other large-scale modeling and monitoring. It is not useful for site-specific calculations. The maps can be downloaded from the CSD web site at: http://csd.unl.edu/csd.htm under "New CSD Publications." Paper copies of the maps are available for $15 from the Conservation and Survey Division; call (402) 472-7523; email: csdsales@unl.edu.

Earth Science for the Global Community Conference

Compiled by Kylee Anderson, NESEN Coordinator

The purpose of this meeting is to provide a venue for earth science and teaching professionals to meet and discuss matters of mutual interest. The conference will be open to those who teach Earth science at any level from primary to university and also to those who develop and deliver outreach programs in the Earth sciences.

The conference will be held at the University of Calgary in Alberta, Canada, from August 11 to August 14. It will include a variety of field trips, including trips to the Royal Tyrrell Museum of Palaeontology and the Calgary Zoo and Prehistoric Park. There will also be speakers, panel sessions, exhibits, and hands-on workshops for participants. Financial assistance may be provided for those who are primary or secondary school teachers. Contact Alan Morgan, avmorgan@uwaterloo.ca, or go online at www.geoscied.org for more information regarding this conference.

UNL Climatologist Sees Little Relief From Drought Conditions This Winter

By Steve Ress, Communications Coordinator, Water Center/School of Natural Resource Sciences

Most of Nebraska will be drier than normal this winter with normal to above normal temperatures, a University of Nebraska-Lincoln climatologist predicts. Although recent rains in parts of Nebraska helped ease this summer's drought, much of the state remains dry. Agricultural climatologist Steve Hu expects that dry pattern to continue statewide.

"I wish I could say we are going to see more precipitation this winter, but that's not what my analysis shows," the Institute of Agriculture and Natural Resources scientist said.

Hu uses sophisticated statistical analysis to predict patterns of precipitation anomalies. His predictions are based on his research, which analyzed 112 years of precipitation data and identified patterns of precipitation

variation for most of the last century. According to his analysis, this winter's temperatures in northern Nebraska should be slightly above normal, with near-normal temperatures in the southern half of the state.

"Precipitation should be on the dry side for northern and western portions of Nebraska. However, there could be above-average precipitation in the southeastern section of the state," Hu said.

His analysis also indicates the dry summers Nebraska has experienced in recent years would continue, possibly for the next five to seven years.

“Not all those years and not all seasons in each year of the next five to seven years will be dry. There will be wet years, but a majority of those years will be on the dry side,” Hu said.

Hu said he has a high degree of confidence in his predictions. They are based on advanced analysis of 112 years of precipitation data collected at weather stations statewide, as well as historical weather data from Kansas, Missouri, Illinois, Iowa, Colorado and Wyoming. These states' weather patterns can strongly influence what happens in Nebraska and help support and amplify the historical data that Hu analyzes.

"Sophisticated data analyses and computer modeling greatly improves the accuracy of predicting weather trends and anomaly patterns. I think it's one of the best methods to predict local rainfall, and I give it a confidence rating of better than 70 percent," Hu said.

His statistical analysis indicates that precipitation patterns follow a 18-23 year cycle. This pattern accurately reflects Nebraska's intensive drought periods during the 1930s, 1950s and the late 1970s. This pattern shows a 10-year wet period ending in the late 1990s, followed by the current extended dry pattern.

"Those extended patterns form from an overall trend that can be examined on a year-to-year basis," Hu said, explaining that not all years in the extended dry period will be dry. "We will have some periods of wet weather within the current (dry) pattern . . . but overall, in the dry phase of the cycle, precipitation will be below normal," he said.

Hu said information from his analysis should be useful to all Nebraskans, especially agricultural producers. He hopes they'll use it to plan what type of crops to plant, what plant density and tillage methods to use, and whether to buy crop insurance to minimize impacts of the dry conditions.

More information on Hu’s analysis is available at the Precipitation and Temperature Predictions For Nebraska Web site at http://snrs.unl.edu/climate/prediction/index.html.

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